21601 Devonshire St. Suite 310
Chatsworth Ca. 91311
www.tetracam.com

Tetracam ADC
Installation and Operation

Rev 1.6

Questions and comments regarding this document should be addressed to;

Steve Heinold
Email steve@tetracam.com

The ADC Camera

The ADC is a single sensor digital camera designed and optimized for capture of visible light wavelengths longer than 520nm and near-infrared wavelengths up to 920nm. The primary use of this product is the recording vegetation canopy reflectance. The resulting image is suitable for derivation of several vegetation indices.
This manual is applicable to ADC units with a case serial number of 220339 and higher.
The camera is available in 3.2 mPel and 5.0 mPel versions.

Before camera images can be retrieved and used you must install an application program and the camera specific USB driver.

Host software and USB driver installation:

On the CD shipped with the camera you will find application folders for PW2 and the optional SensorLink (if you purchased it).

If your computer does not have the Microsoft .NET 2.0 framework installed, the PixelWrench2 installer will try to open Microsoft.com and download a file called dotNetfx.exe. This is the installer for .NET 2.0. This file is also on the CD in the root directory where you can run it directly prior to installing PixelWrench2.

PixelWrench2
PixelWrench2 is a powerful image editing program with several tools specific to multi-spectral images and working with Tetracam ADC and MCA cameras.
Open the PW2 folder and run Setup.Exe. This will install PixelWrench2. See the PixelWrench2 online help for more information.
PW2 can open ADC proprietary DCM10, RAW10 and RAW8 image files along with several standard image file types (BMP, JPEG, TIF, PNG etc.)

SensorLink
If you purchased the optional SensorLink application you will find a folder by that name on the CDROM included with the camera.
SensorLink is a GPS waypoint triggering application enabling camera triggering at pre-defined waypoints. It uses the same .NET 2.0 framework. Simply run Setup.exe in the SensorLink folder to install it. See the SensorLink online help for more information.

Connecting the camera:

Connect the USB cable from a working USB port on the computer to the connector labelled USB on the camera interconnect panel. Apply 12VDC with **Center Positive** polarity to the power connector. The small wall plug type power supply shipped with the camera is provided for this or you may install 8 AA size batteries following the polarity diagram on the camera product label.

USB driver installation:

On Windows XP systems, the first time the camera is connected to a USB port, Windows will fire the *New Hardware Found* wizard. This will guide you through installation of the camera driver called SvStream.sys. Do not let Windows search for the driver. In every case select the option where you specify the name and location of the driver. The driver SvStream.sys and it's information file SvStream.inf will be copied to your Windows/System32/Drivers folder when you install either PixelWrench2 or SensorLink. When the driver installation wizard asks for a location browse to Windows/System32/Drivers.
When the driver has been installed you will be able to communicate with the camera.

In both PixelWrench2 and SensorLink, you are required to specify the camera type prior to accessing the camera. In PixelWrench2, on the Camera Toolbar, click the small down arrow on the top button (Status). Select ADC as your cameratype. This loads the correct DLL for use with the ADC.
See the PixelWrench2 online helpfile for further specifics on camera communications.

USB Disk Configuration:

With the introduction of firmware version **5.097** the ADC can be configured to appear as a USB disk drive to the operating system. To use the camera in USB disk mode simply hold the Select button down when you power up the camera. Continue to hold the Select button until the camera display lights up. You can now copy or download files directly from the camera CF card directly. This mode of operation is useful if you need to transfer files from the camera onto a system that does not have the SvStream driver installed on it.
When using the camera in USB disk mode, the PixelWrench camera toolbar commands are not available. You can however access the CF card by simply using the File/Open command in PW2 and selecting the drive letter representing the camera.

To revert to normal Streamdriver mode just cycle the camera power.

Camera Physical Layout and Interconnects

The ADC is comprised of a compact single circuit board assembly, a machined aluminum housing incorporating a battery compartment, a lensmount and interconnection panel .

The image size is 2048 x 1536 pixels (3.2mPel) or 2560 x 1920 (5.0 mPel), both ½" optical format. The image sensor is oriented to the same aspect as the camera housing, ie the long dimension of the sensor is in line with the long dimension of the housing. Mounting the camera long dimension parallel to the aircraft fuselage results in an image with the long axis parallel to the direction of flight. This allows for maximum overlap while maintaining the maximum usable image.

All the electrical interconnections for the camera are on one endpanel. The opposite endpanel has the CF card access door and battery door.

The interconnects provided are;

Video Out – configurable for NTSC or PAL
Trigger – Plug the optional external trigger unit into this connector.
Power – The camera requires a 12VDC, center positive polarity supply capable of delivering 0.5 Amps continuous. The supplied wallplug type supply connects to this jack.
USB – The main USB I/O connector.
Multi I/O – This 17 pin connector is allocated to the Tetracam Videoviewer accessory. The Videoviewer features a 6" LCD display, control buttons for triggering, menu operations and power switching. It has it's own power supply, input for an external supply and input for a GPS receiver.
GPS In – A mini-stereo (3 pin) connector allocated for connection of a GPS unit. The camera serial port is configured 4800 – 8 – N –1, the NMEA 0183 standard configuration. The camera firmware is designed to listen for the NMEA RMC sentence. If found, the entire sentence is written to the image status string (header) for extraction by application software.

CF card access – All images are written to Compact Flash cards, each camera unit carries it's own card. Access to the cards is through the small door next to the battery door. Cards are formatted FAT32 and can

be removed and read on any host computer with a CF card reader. All data on the card can be transferred over the USB port using the application software if desired.

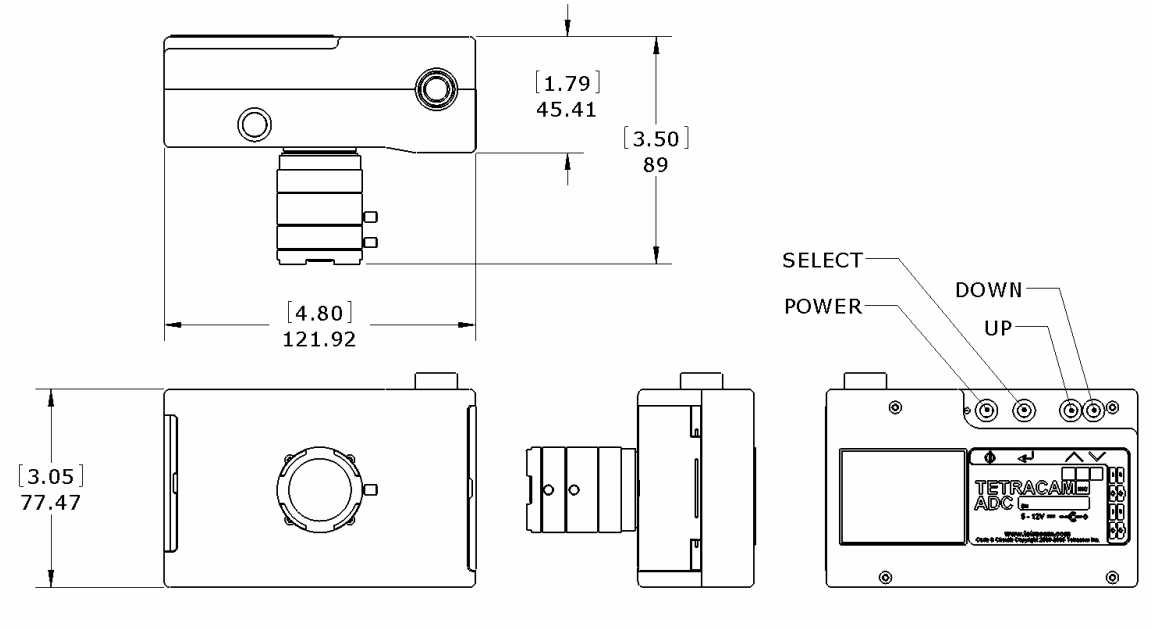
Optics and Filters

The camera is typically supplied with one of two lenses.

An 8.5mm C-mount fixed focal length objective;
or
A 4.5 to 12mm CS mount varifocus lens.
The lens focal length is adjustable from 4.5 (wideangle) to 12mm (slight telephoto). After making a focal length adjustment, the focus must be checked and adjusted. The lens aperture is also adjustable. All three adjustments can be locked at any setting using the small thumbscrews on the lens barrel.
Alternatively, the camera may be supplied with an 8.5mm focal length C-mount lens and adapter bushing. In the case of non-varifocus lenses, an infinity focus mark will appear on the lens. Set the lens to this mark when shooting at distance, aerial images for example. Any lens used on the ADC should be CS-mount or C-mount in combination with a 5mm thick adapter ring. Any lens should be designed for use with ½" or larger optical format sensors.
Permanently mounted behind the lens is the longpass filter. Touching this filter should be avoided, clean using a soft clean cloth or lens tissue.

Mounting the Camera

The ¼"-20 tripod socket on the bottom surface is ideal for attaching the camera to standard tripods as well as any custom designed camera mounts. When used in aerial applications, it is always advisable to provide vibration isolation between the camera and aircraft. Additionally make sure to ground the camera housing to the mount. If the camera is mounted on non-conducting vibration isolators a ground strap should be provided. Dress and restrain all interconnect cables to prevent snagging or undue disturbance by propblast etc. The ADC camera housing and optics are not weatherproof. If the camera is mounted externally, weather protection should be provided.



It is the user's responsibility to insure that the camera is properly and safely mounted and is in conformance with any applicable aviation regulations.

Using the ADC Camera System

Simple Un-tethered Operation
The ADC is designed for ground based and aerial photography and to that end, it's basic operation is simple. Although very extensive camera management operations can be done on the ground or in flight, basic image capture is no more complex that pressing a button. When power is applied to the camera it will initialize itself and come ready in less than 2 seconds. Simply press and release the trigger button. The camera will calculate an exposure time and capture the image. The LED will turn red briefly indicating camera busy. When the LED returns to green the camera is ready to capture again. This "mode" allows the camera to calculate a new exposure time between images.
If burst mode is enabled (menu selection), to initiate *burst capture* simply press and hold the trigger button. The camera will calculate the exposure to be used for all the shots in the sequence and begin capturing frames at the burst capture rate of a frame every 2 seconds until the memory buffers are full. The buffer contents are continually written to Compact Flash so when sufficient buffer space is free, another image will be captured. This continues until the trigger button is released.

Adjusting Exposure;
The camera powers up in Auto Exposure Mode. To adjust auto exposure, simply press and hold the Up and Down arrow buttons. You will see the display become brighter or darker. The adjustment remains until the camera is powered off or the exposre mode is changed on the menu. To set a fixed exposure, set the desired time on the menu. The viewfinder will display "Fixed xx.x" in the lower left corner. To change the exposure time, press the Up or Down arrow button. The new exposure time will be displayed.
If a video display is connected to video-out it will freeze during image capture and slow significantly during image compression (writing out the memory buffers), this serves as another indication of the camera ready/busy state.
If a GPS unit configured to speak NMEA RMC is connected to the camera, it's output will be recorded in each image header.

Tethered Operation
Tethered means connected to and communicating with a host computer. While tethered operation provides management and control features not available otherwise, it requires a portable computer and an application program. The ADC ships with PixelWrench2 which has a full camera host interface built in. Camera statusing, setup, triggering, an on-screen viewfinder function, and file transfer operations are all available from PixelWrench2.
SensorLink and Tracker also provide manual or automated tethered operation, triggering the camera at geographical waypoints read from a user prepared list.
If a video display is connected to the camera it will continue to function in tethered mode.

Note:
The user is advised not to trigger more than one picture at a time when connected to USB.
If a *burst mode* capture was executed in un-tethered configuration, wait until burst operations are completely finished before plugging the camera in and opening the port.

See the PixelWrench2, SensorLink or Tracker helpfiles for more specific information on tethered camera operation.

Tetracam Videoviewer Operation
Connection to the Tetracam Videoviewer is simple, just attach the cable supplied with the Videoviewer to the Multi I/O connector on the camera. Controls on the Videoviewer allow manual triggering of the camera and access to the camera menu system.

The LCD display Camera Menu
The camera menu is displayed on the LCD located on the back of the camera. When the TV setting is set to Video output, the menu is also visible on the Videoviewer.
Four buttons are located on the back surface of the camera, reading from left to right the button functions are;

1. Power On / Off
2. Enter Menu / Select
3. Scroll UP
4. Scroll Down

To enter the menu display press button 2.
To navigate the menu scroll up or down and press Select to open the associated sub menu
To exit the menu, scroll to "DONE" and press select or press the camera shutter release.
To change a specific configuration item, navigate to the item and press Select. The associated item will turn from white to green.
Use the Up and Down buttons to toggle through possible settings.
When the required setting is displayed, press Select to set it, item will turn to white from green.

2.0 Main Menu

The main menu provides several sub-menus. Only sub-menus that can provide meaningful options will be active at any time.

The sub-menus are;

Review – Opens review submenu
Info - Displays camera info including battery state, firmware version, memory free and used.
Setup - Opens setup submenu
Done - Exit the menu

The following sections describe the specific submenu functions.

3.0 Review Submenu Items

Thumbnail – Displays thumbnails of images, use Up and Down buttons to scroll.
Fullscreen – Displays full image on LCD, use Up and Down buttons to scroll.
Directory – Displays a list of images, use Up and Down buttons to scroll. Press Select to Display image and associated data.
Delete All – Deletes all images.
Done – Exit submenu, return to Main menu.

4.0 Info Submenu

The Info screen displays basic camera information.
Battery: describes battery state
Version: firmware version
Memory
Used: memory used by captured images
Free: memory remaining
Size: size of installed Compact Flash card

5.0 Process Submenu Items

The following items affect Jpeg compressed images only;
Jpg – Allows selection of Jpeg compression level
Contrast – Allows selection of Gamma applied to jpeg images
White – Allows selection of auto or several illumination type white balance settings
Save – Saves settings

6.0 Setup Submenu Items

Timeout – Sets camera auto shutdown timer
TV – Selects the viewfinder output device, LCD or Video (Pal or NTSC)
Date/ Time – Allows date and time settting
Alarm – Provides settings for the alarm triggering system
Quickvw – Selects the image review display mode, Raw, IPVI mono or IPVI color

Restore Defaults – Resets these settings to camera defaults
More… Opens the second page of the main menu.
Save – Saves settings

7.0 QuickVw Submenu Items

Note: Some of these items are specific to the LCD back camera only.

Mode - Toggles thru three modes of image display;
Raw - A "false color" processed image
IPVI Mono - A grayscale IPVI of the raw image
IPVI Color - A "palletized" IPVI image.
Time - Allows setting the Quick Review display period from 0 to 10 seconds
Done - Exits the submenu

8.0 Main Menu Second Page (MORE…)

Save Mode – Selects DCM10, RAW8 or RAW10 bit filetype.
Format – Formats the CF card. Overwrites all existing data on card.
Lang – Selects display language.
Fixed Exp – Sets exposure time. Set to 0 for auto exposure. Use the Up and Down arrow buttons to set fixed exposures from 0.5 to 25 milliseconds.
Burst Delay – Allows setting of a delay between burst exposures.
Burst – Sets or disables burst mode.
GPS Baud – Sets the GPS receive baud rate

Troubleshooting the ADC

The ADC is a very durable and reliable device but like all complex instruments trouble can occur. In most cases the difficulty can be remedied by a camera reset. If the problem occurs repeatedly the battery charge state should be verified.

The ADC derives it's exact operating personality from the firmware loaded to it's microprocessor. This firmware (camera code) is loaded to the camera over the USB interface using PixelWrench2.
It should not become necessary to reload the camera code. If after consultation with Tetracam support personnel it is decided to reload the firmware the following considerations must be made;

- ? Insure that the correct firmware version is being loaded. The camera firmware files carry a .bin extension.
- ? Insure that the camera has sufficient power to operate throughout the download and initialization process. It is recommended that new batteries or the 12VDC external supply are used during firmware downloads.
- ? Insure that sufficient time is allowed for the firmware to complete it's write and initialization. After the dialog box appears stating that firmware download is complete, allow 30 seconds for the code to finish writing to memory and initializing the camera setup file before accessing the camera or disconnecting power.

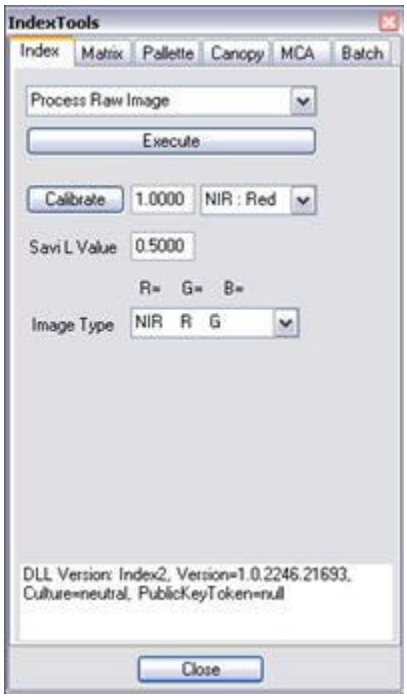
Failure to observe the above cautions could result in the need to return the camera to the manufacturer.

In rare instances, the camera NVram can become corrupted. To re-format the internal NVram do the following;

Hook the camera up to the 12VDC supply that shipped with the camera.
Hold down the DOWN arrow key and the TRIGGER (picture taking) button.
While holding the two buttons, press the POWER button.
Wait at least 90 seconds for Nvram to be re-formatted and written before attempting any other camera operations.

Managing and Processing ADC Images
ADC Specific Features in PixelWrench2

The ADC system writes losslessly compressed image files or RAW files to the CF card for every image. These images carry the extension *.DCM or *.RAW. PixelWrench2 offers all the tools needed for management of ADC images located on the pages of the IndexTools form.



There are four ways to retrieve images from the ADC;

1. Remove the CF card from the camera and copy it's contents to a folder on your computer. The *.DCM and *.RAW files can then be opened directly in PixelWrench2.

2. In PixelWrench2; open the camera toolbar then click *Open Camera*. The camera inventory screen will appear with thumbnails of all the images. Select an image (or images) then click *Load*. The image(s) will be extracted from the camera, color processed using the matrix values entered and stored by the DLL and displayed on screen as an RGB dib.

3. In PixelWrench2, click *Save DCA* on the CameraToolbar. A filesave dialog will appear allowing designation of a filename and target location. A single archive file will be created containing all the DCM files on the CF card. The resulting DCA file can then be opened and individual images can be extracted from it using PixelWrench2.

4. Power up the camera in USB disk mode and open *.DCM or *.RAW files directly using PW2.

Important!

DCM and RAW files are grayscale images displaying "raw" pixel values. The DCM or RAW file must be color-processed prior to further use. When opening an image directly from the camera (or a DCA file) you can choose to let the camera library (DLL) do the color processing by clicking *Load* on the camera inventory dialog or you can import the image un-processed by clicking *Load Raw*. The raw image can then

be color processed using the tools in PixelWrench2. Color process files (*.cpf) named *32_standard.cpf* , and *50_standard.cpf* are included on the installation CD. You will find them in the Support folder under the PixelWrench2 application folder.

See the PixelWrench2 helpfile for more information.

Specifications

3.2 megapixel CMOS sensor , 2048 x 1536
or
5.0 megapixel CMOS sensor, 2560 x 1920
Permanently mounted longpass filter behind lens
Image storage to CompactFlash in Tetracam RAW or DCM lossless format.
CS-mount system compatible with thousands of available lenses.
(supplied with 4.5 – 12mm CS-mount or 8.5mm C-mount lens)
USB interface
Multipin I/O connector for use with Tetracam Videoviewer accessory.
CNC machined aluminum enclosure

Image Capture
Capacity: (DCM10) Approx. 2.3mB per image (3.6 mB per image)
(RAW10) 6.15mB per image (10.0 mB per image)
(RAW8) 3.07mB per image (5.0 mB per image)

Rate: Single Shot –(DCM10) Capture to end of compression and write: 7 sec.
(RAW10) Capture to ready : 4 sec.
(RAW8) Capture to ready : 3 sec.
Burst Mode – 1 frame every 2 seconds until buffer full.

Inputs
5 – 12 VDC
Rs-232 dedicated to capture of NMEA GPS sentences
External Trigger

Outputs
LCD viewfinder, image review and menu operations.
Realtime NTSC or PAL Video for both viewfinder and menu operations

Data Interface
USB 1.1

Dimensions
4.8 x 3.0 x 1.6 in. (122 x 78 x 45mm) without lens
12 oz. (460 gr.) without internal batteries
18 oz. (640 gr.) with alkaline AA batts.

Misc.
Standard ¼-20 tripod socket, centered under lens

System Includes
Camera and Lens
256mB CF card

USB Cable
AC/DC power supply
Teflon calibration tag
8 AA batteries
Tetracam PixelWrench2 Application Software (for Windows)
Rugged carrying case